

- 11 **Borg G**. Simple ratings for estimation of perceived exertion. In: Borg G, eds. *Physical work and effort*. New York: Pergamon Press, 1975:39–46.
- 12 **Stewart KJ**, Turner KL, Bacher AC, et al. Fitness, fatness, and activity as predictors of bone mineral density in older persons. *J Intern Med* 2002;**252**:381–8.
- 13 **Mosteller RD**. Simplified calculation of body-surface area. *N Engl J Med* 1987;**317**:1098.
- 14 **Stewart KJ**, DeRegis JR, Turner KL, et al. Usefulness of anthropometrics and dual-energy x-ray absorptiometry for estimating abdominal obesity measured by magnetic resonance imaging in older men and women. *J Cardiopulm Rehabil* 2003;**23**:109–14.
- 15 **Katz A**, Nambi SS, Mather K, et al. Quantitative insulin sensitivity check index: a simple, accurate method for assessing insulin sensitivity in humans. *J Clin Endocrinol Metab* 2000;**85**:2402–10.
- 16 **MacGowan GA**, Shapiro EP, Azhari H, et al. Noninvasive measurement of shortening in the fiber and cross-fiber directions in the normal human left ventricle and in idiopathic dilated cardiomyopathy. *Circulation* 1997;**96**:535–41.
- 17 **Sung J**, Ouyang P, Bacher AC, et al. Peripheral endothelium-dependent flow-mediated vasodilatation is associated with left ventricular mass in older persons with hypertension. *Am Heart J* 2002;**144**:39–44.
- 18 **Chobanian AV**, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003;**289**:2560–72.
- 19 **Mockel M**, Stork T. Diastolic function in various forms of left ventricular hypertrophy: contribution of active Doppler stress echo. *Int J Sports Med* 1996;**17**(suppl 3):S184–90.
- 20 **Di Bello V**, Giorgi D, Pedrinelli R, et al. Left ventricular hypertrophy and its regression in essential arterial hypertension: a tissue Doppler imaging study. *Am J Hypertens* 2004;**17**:882–90.
- 21 **Fischer M**, Baessler A, Hense HW, et al. Prevalence of left ventricular diastolic dysfunction in the community: results from a Doppler echocardiographic-based survey of a population sample. *Eur Heart J* 2003;**24**:320–8.
- 22 **Pascual M**, Pascual DA, Soria F, et al. Effects of isolated obesity on systolic and diastolic left ventricular function. *Heart* 2003;**89**:1152–6.
- 23 **Peterson LR**, Waggoner AD, Schechtman KB, et al. Alterations in left ventricular structure and function in young healthy obese women: assessment by echocardiography and tissue Doppler imaging. *J Am Coll Cardiol* 2004;**43**:1399–404.
- 24 **Jain A**, Avendano G, Dharamsey S, et al. Left ventricular diastolic function in hypertension and role of plasma glucose and insulin: comparison with diabetic heart. *Circulation* 1996;**93**:1396–402.
- 25 **Mureddu GF**, de Simone G, Greco R, et al. Left ventricular filling pattern in uncomplicated obesity. *Am J Cardiol* 1996;**77**:509–14.
- 26 **Mureddu GF**, Greco R, Rosato GF, et al. Relation of insulin resistance to left ventricular hypertrophy and diastolic dysfunction in obesity. *Int J Obes Relat Metab Disord* 1998;**22**:363–8.
- 27 **Sasson Z**, Rasooly Y, Gupta R, et al. Left atrial enlargement in healthy obese: prevalence and relation to left ventricular mass and diastolic function. *Can J Cardiol* 1996;**12**:257–63.

IMAGES IN CARDIOLOGY

doi: 10.1136/hrt.2005.076315

The “mobile-phonocardiogram”, a new tool in the arrhythmia clinic

A 20 year old man presented to our clinic complaining of palpitations. He had been under cardiological follow up since childhood for a symptom-free ventricular septal defect. He took no medication and was fit and well. He played sport twice per week, did not smoke or drink excess alcohol. He had felt palpitations occasionally since age 15 but they had recently become more frequent, especially at rest after playing sport. On one of these occasions he had recorded his own cardiophonogram using a mobile phone handset pressed against his chest. Physical examination demonstrated a grade 4/6 ejection systolic murmur. His resting ECG was normal. He achieved

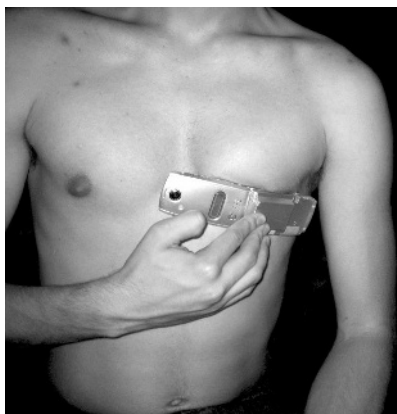
stage 5 of the Bruce protocol; this did not induce symptoms. A two dimensional echocardiogram demonstrated a ventricular septal defect with a 1:1.2 shunt. Three dimensional echocardiography revealed three 3 × 3 mm defects just below the tricuspid valve. The right heart was not dilated. A 24 hour Holter monitor showed normal sinus rhythm throughout with occasional supraventricular ectopics.

We analysed the phonocardiogram using commercially available audio editing software. His heart rate was clearly discernible as a regular 76 beats per minute. On examination of his phonocardiogram the first heart sound and his murmur are clearly visible, despite small

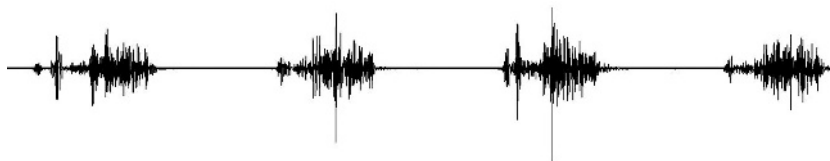
amounts of interference. His diastolic interval was constant, ruling out tachy- or bradyarrhythmias.

Mobile telephones have become ubiquitous in developed societies over the last 10 years. Increasingly, the devices have a functionality which has been attempted to be put to use for medical uses outside of their communication role—for example, ambulatory ECG monitoring. Our patient used his mobile phone to perform and record part of the routine cardiac examination while he was experiencing symptoms, which was later used as an invaluable aid to his diagnosis.

M Finlay, A Porter, K Fox
mcfinlay@doctors.net.uk



Patient demonstrating method used in self-recording heart sounds during palpitations.



The audio waveform derived from the mobile phone recording during palpitations.